

WHAT IS CLAIMED IS:

1. A method for controlling the size of the molten pool in a laser based additive manufacturing process, comprising:

5 imaging, with an imaging device, a molten pool on a substrate, the molten pool created by a laser;

comparing at least one characteristic of the molten pool with a respective characteristic of a target molten pool; and

10 adjusting, in substantially real-time, a laser power of the laser based on the comparison in order to correlate the characteristic of the molten pool with the respective characteristic of the target molten pool.

15 2. The method of Claim 1, wherein the imaging device is an infrared camera, the method further comprising coaxially aligning the infrared camera with a laser nozzle.

3. The method of Claim 2, wherein the infrared camera is a high frame rate charge coupled device camera.

20 4. The method of Claim 3, wherein imaging the molten pool comprises imaging the molten pool at a rate of up to approximately 800 frames per second.

5. The method of Claim 1, wherein imaging the molten pool comprises imaging the molten pool at a resolution of approximately 128x128.

25 6. The method of Claim 1, further comprising filtering the radiation from the molten pool with a laser filter before it reaches the imaging device.

30 7. The method of Claim 1, further comprising filtering the radiation from the molten pool with an infrared filter before it reaches the imaging device to obtain a radiation wavelength between 0.7 and 1.06 micrometers.

8. The method of Claim 1, further comprising adjusting the intensity of the radiation from the molten pool before it reaches the imaging device.

5 9. The method of Claim 1, wherein comparing at least one characteristic of the molten pool comprises comparing a size of the molten pool.

10. The method of Claim 1, wherein comparing at least one characteristic of the molten pool comprises comparing a shape of the molten pool.

11. Logic encoded in media for controlling the size of the molten pool in a laser based additive manufacturing process, the logic operable to:

receive an image from an imaging device of a molten pool on a substrate, the molten pool created by a laser;

5 compare at least one characteristic of the molten pool with a respective characteristic of a target molten pool; and

adjust, in substantially real-time, a laser power of the laser based on the comparison in order to correlate the characteristic of the molten pool with the respective characteristic of the target molten pool.

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12. The logic encoded in media of Claim 11, wherein the infrared camera is a high frame rate charge coupled device camera.

13. The logic encoded in media of Claim 11, wherein the image comprises a resolution of approximately 128x128.

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14. The logic encoded in media of Claim 11, the logic further operable to compare a size of the molten pool.

20 15. The logic encoded in media of Claim 11, the logic further operable to compare a shape of the molten pool.

16. A system for controlling the size of the molten pool in a laser based additive manufacturing process, comprising:

a laser operable to create a molten pool on a substrate through a laser nozzle;

5 an imaging device coaxially aligned with a laser nozzle, the imaging device operable to image the molten pool;

a controller coupled to the imaging device, the controller operable to compare at least one characteristic of the molten pool with a respective characteristic of a target molten pool; and

10 the controller operable to adjust, in substantially real-time, a laser power of the laser based on the comparison in order to correlate the characteristic of the molten pool with the respective characteristic of the target molten pool.

15 17. The system of Claim 16, wherein the imaging device comprises an infrared camera.

18. The system of Claim 17, wherein the infrared camera is a high frame rate charge coupled device camera.

20 19. The system of Claim 18, wherein imaging device is operable to image the molten pool at a rate of up to approximately 800 frames per second.

25 20. The system of Claim 16, wherein imaging device is operable to image the molten pool at a resolution of approximately 128x128.

21. The system of Claim 16, further comprising a laser filter operable to filter the radiation from the molten pool before it reaches the imaging device.

22. The system of Claim 16, further comprising an infrared filter operable to filter the radiation from the molten pool before it reaches the imaging device to obtain a radiation wavelength between 0.7 and 1.06 micrometers.

5           23. The system of Claim 16, further comprising an iris operable to adjust the intensity of the radiation from the molten pool before it reaches the imaging device.

10           24. The system of Claim 16, wherein the at least one characteristic of the molten pool comprises a size of the molten pool.

          25. The system of Claim 16, wherein the at least one characteristic of the molten pool comprises a shape of the molten pool.

26. A system for controlling the size of the molten pool in a laser based additive manufacturing process, comprising:

means for imaging a molten pool on a substrate, the molten pool created by a laser;

5 means for comparing at least one characteristic of the molten pool with a respective characteristic of a target molten pool; and

means for adjusting, in substantially real-time, a laser power of the laser based on the comparison in order to correlate the characteristic of the molten pool with the respective characteristic of the target molten pool.